

CLAIMS

1. A sub-atmospheric downstream pressure control apparatus (200), characterized by:

- 5 a first flow restricting element (FRE)(202);
a pressure control chamber (PCC) (204) located in serial fluidic communication downstream from said first FRE;
a second FRE (206) located in serial fluidic communication downstream from said PCC;
10 a gas source (208); and
a flow controlling device (210) in serial fluidic communication downstream from said gas source and upstream from said PCC.

2. A sub-atmospheric downstream pressure control apparatus as in claim 1 further characterized by:

- 15 a reactive gas source (422) connected in serial fluidic communication upstream from said PCC; and
an abatement element (420) located within said PCC.

3. A sub-atmospheric downstream pressure control apparatus as in claim 1 further characterized by:

- 20 a third FRE (504) connected in serial fluidic communication downstream from said PCC;
an abatement chamber (502) connected in serial fluidic communication downstream from said third FRE;
a reactive gas source (506) connected in serial fluidic communication upstream from
25 said abatement chamber; and
an abatement element (520) disposed within said abatement chamber.

4. A sub-atmospheric downstream pressure control apparatus as in claim 1 wherein a process chamber (304) is located in serial fluidic communication upstream from said first FRE;

- 30 said process chamber and said PCC (308) are formed as compartments within a single process vessel (324); and
said first FRE (306) is formed within the partition between said process chamber and said PCC.

5. A wafer processing apparatus comprising a process chamber (10), said apparatus characterized by;

a process reactive gas supply line (12) from a process gas source in serial fluidic communication upstream from said process chamber;

5 an upstream flow control device located in serial fluidic communication upstream from said process chamber and downstream from said process gas source;

a first flow restricting element (202) located in serial fluidic communication downstream from said process chamber;

10 a pressure control chamber (PCC) (204) located in serial fluidic communication downstream from said first FRE;

a second FRE (206) located in serial fluidic communication downstream from said PCC;

a gas source (208); and

15 a flow controlling device (210) in serial fluidic communication downstream from said gas source and upstream from said PCC.

6. A sub-atmospheric downstream pressure control apparatus as in claim 5 further characterized by:

a reactive gas source (422) connected in serial fluidic communication upstream from said PCC; and

20 an abatement element (420) located within said PCC.

7. A sub-atmospheric downstream pressure control apparatus as in claim 5 further characterized by:

a third FRE (504) connected in serial fluidic communication downstream from said PCC (200);

25 an abatement chamber (500) connected in serial fluidic communication upstream from said third FRE;

a reactive gas source (506) connected in serial fluidic communication upstream from said abatement chamber; and

an abatement element (520) located within said abatement chamber.

30 8. A sub-atmospheric downstream pressure control apparatus as in claim 5 wherein a process chamber (304) is located in serial fluidic communication upstream from said first FRE (306);

said process chamber and said PCC (308) are formed as compartments within a single process vessel (324); and

said first FRE is formed within the partition between said process chamber and said PCC.

9. A sub-atmospheric downstream pressure control apparatus as in claim 5 wherein said process is LPCVD.

5 10. A sub-atmospheric downstream pressure control apparatus as in claim 5 wherein said process is RIE.

11. A sub-atmospheric downstream pressure control apparatus as in claim 5 wherein said process is PECVD.

10 12. A downstream pressure control method, comprising controlling a flow of process gas into a process chamber; said method characterized by:
providing a flow of gas into a pressure control chamber (PCC) connected in serial fluidic communication downstream from said process chamber;
controlling fluid flow with a first flow restricting element (FRE) located in serial fluidic communication downstream from said process chamber and upstream from said
15 PCC; and
controlling the pressure at said process chamber by adjusting the pressure in said PCC to impact the pressure gradient over said first flow restricting element.

13. A method for sub-atmospheric reactive gas abatement, characterized by:
providing a substantial pressure gradient at an inlet to an abatement space;
20 providing a substantial pressure gradient at an outlet from said abatement space;
flowing a reactive abatement gas into said abatement space;
reacting with process gas exhaust effluents to produce substantially stable and inert solid; and
substantially localizing said substantially stable and inert solid within said abatement
25 chamber.

14. A method for sub-atmospheric reactive gas abatement of process gas exhaust effluent, said method characterized by:
providing a substantial pressure gradient at an inlet to an abatement space;
providing a substantial pressure gradient at an outlet from said abatement space;
30 flowing a reactive abatement gas into said abatement space;
reacting said reactive abatement gas with said process gas exhaust effluent to produce a substantially volatile effluent gas; and

transporting said substantially volatile effluent gas through a pump foreline and pump substantially without further reaction and substantially without growth of film deposits.

15. A wall-protected process chamber (710, 730), comprising:

- 5 an external enclosure (602);
- a gas permeable internal enclosure (604) disposed within said external metallic enclosure and enclosing said process chamber;
- a seal (608, 610) between said internal enclosure and said external metallic enclosure, said internal enclosure and said external enclosure defining a
- 10 substantially sealed space (606) between the outer wall of said internal enclosure and the inner wall of said external metallic enclosure; and
- a source (612) of a pressurized inert gas in fluid communication with said sealed space; whereby said pressurized inert gas flows through said gas permeable internal enclosure to protect said process chamber wall.

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